Open Meeting on LHC

Ideas for a Physics Analysis Center

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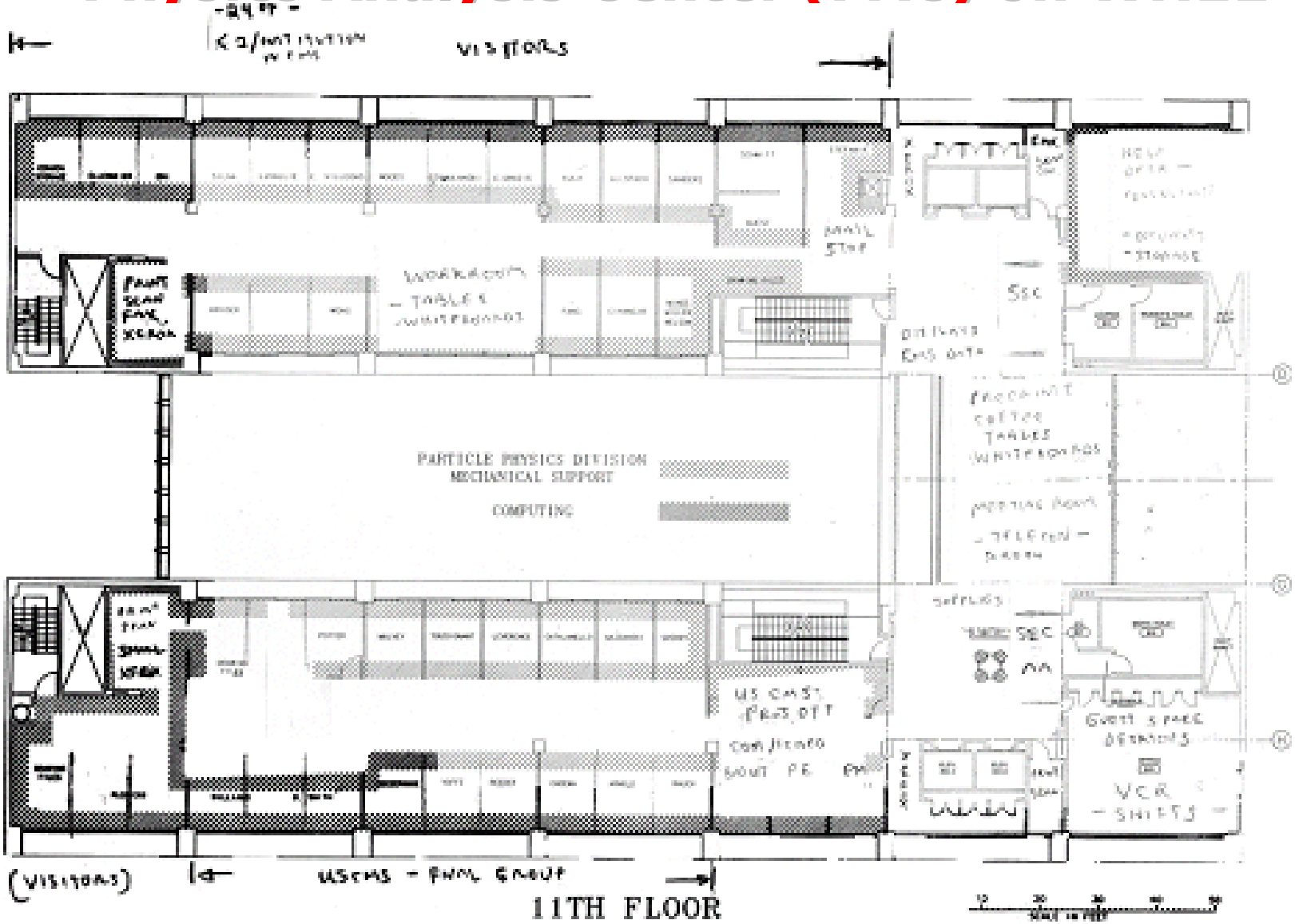
Contributions

- **Initial discussions: Steve Mrenna, Heidi Schellman, John Womersley**
- **Inputs from**
- **J. Rohlf, M. Schmitt, J. Qian, M. Della Negra, T. Mueller, P. Sphicas, M. Shapiro, H. Frisch, L. Orr, P. Tipton, T. Ferbel, P. Slattery, K. McFarland, D. Green, R. Field, S. Eno, M. Mangano, J. Incandela, M. Zielinski, M. Kado**

- **CMS people expressed a substantial interest in Tevatron expertise**

The Virtual Control Room (VCR) and Physics Analysis Center (PAC) on WH11



VCR and PAC at FNAL

- During LHC data taking
  - A place to take shifts (think control room of a space station)
  - Administrative help
  - Meeting place of analysis groups (video to CERN,…)
  - A place to do analysis:
    - Access to computing resources, expertise (see Lotar's talk)
    - Information exchange with theorists and other experimenters

  (I will not concentrate on this…)
- Now a lot of LHC physics activity is going on
  - Simulation, reconstruction, visualization codes developed
  - Simulation tuned on test-beam data
  - CMS Trigger TDR completed
  - Studies of sensitivity and reach
  - A lot of people are already doing LHC physics full time!
- So what is so special about the Fermilab PAC now, that the Tevatron is taking data and many of us are heavily involved in analysis?
  - There are deep connections between LHC physics and Tevatron physics
  - These connections can be exploited to benefit both without doubling the effort:
    - 1+0.2=2
  - Advantage of Fermilab
    - Many students and postdocs are here (CDF/DØ +CMS hardware)

Tevatron and LHC physics

- Tevatron is the energy frontier for next 4-5 years
- The most important input for LHC will be the discoveries made by the Tevatron
- In addition, Tevatron data and analysis provide
  - Invaluable experience and training
  - Useful measurements that will help to constrain the backgrounds and systematics for the LHC
- Documentation/discussions are important
  - PAC = discussion forum
    - series of workshops (essential to attract young people)
  - Documentation
    - Chapters in Physics TDR
    - "Tevatron Know-How"
- Need professional help to connect Tevatron and LHC physics in practice
  - Compatible high-level analysis code and/or conversion to compatible data formats CMS←→ CDF/DØ
  - Monte Carlo generators
    - Machinery to tune MC on Tevatron data and apply to LHC scenarios
    - Input from theorists on best ways to extrapolate from Tev to LHC energies

"Tevatron Know-How"

Control samples and procedures

- detector commissioning/calibration
- tracking calibration
- software commissioning
- software/computing with large data sets
- in-situ calibration methods
- high level trigger, analysis planning strategy
- flavor(b/c) tagging
- tau-id
- jet tagging (forward jets)
- fake rates for photons
- methods for determining fake rates for leptons
- charged multiplicity in silicon detectors
- material modeling/verification
- dijet mass resolutions
- "portability" of control samples (jet(tt)≠jet(qcd+gamma)) (!)

Interesting Physics

- underlying events, min-bias, heavy flavor in min-bias
  - This work was started by R. Field
  - Immediately the need for more detailed information (distributions instead of means)
  - Shows why this work should be done now when the Tevatron data is easily accessible
- PDF's
- Multi-jet production
- Structure of hadronic final states
  - Structure of jets, fragmentation functions of b quarks
- W/Z+jets, heavy flavor
- W/Z – photon coupling
- Fake W/Z
- dibosons, +jets
- top, top+jets, top+b-jets
- Heavy flavor content of jets
- Multiple (>2) b quark production
- Gamma-gamma backgrounds
- Multiparton interactions

Areas of activity for PAC now

- Calibration of Monte Carlo generators on Tevatron data
  - Ongoing effort at FNAL (http://cepa.fnal.gov/CPD/MCTuning/index.html)
- Simulation calibration on test beam data
  - already going on for HCAL
- Documentation of Tevatron "know-how" and analysis of applications at LHC
  - Essential to have procedures and triggers for control data sets on the first day of data taking
- Verification of algorithms for LHC in Tevatron environment
  - E.g. tagging forward jets
- Verification of high-level trigger algorithms and trigger rates
  - This is more subtle and for the future

What Fermilab can do

- Keep Tevatron running
- Provide forum for Tevatron-LHC discussions
  - Essential to give young people visibility
- Space, infrastructure, high quality video connections
- Professional help
  - Administrative
  - Computing support
  - Help with CMS software infrastructure
  - Monte Carlo generators
  - Training and user support in the GMT -4-10 time zones
- Essential that Fermilab supports future R&D projects to keep a critical mass (and especially students and postdocs) on site
- Last but not least, quality of life
  - Hostel upgrade (private bathrooms would be a nice touch)
  - High quality office space